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PERFORMANCE EVALUATION OF FULL SCALE UASB REACTOR IN TREATING STILLAGE WASTEWATER

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ABSTRACT

Upflow anaerobic sludge blanket (UASB) reactors have been widely used for treatment of industrial wastewater. In this study two full-scale UASB reactors were investigated. Volume of each reactor was 420 m^3. Conventional parameters such as pH, temperature and efficiency of COD, BOD, TOC removal in each reactor were investigated. Also several initial parameters in designing and operating of UASB reactors, such as upflow velocity, organic loading rate (OLR) and hydraulic retention time were investigated. After modifying in operation conditions in UASB-2 reactor, average COD removal efficiency at OLR of 10–11 kg COD / m^3 day was 55 percent. In order to prevent solids from settling, upflow velocity was increased to 0.35 m/h. Also to prevent solids from settling, the hydraulic retention time of wastewater in UASB-2 reactor was increased from 200 to 20 hours. This was expected that with good operation of UASB-2 reactor and with expanding of granules in the bed of the reactor, COD removal efficiency will be increased to more than 80 percent. But, because of deficiency on granulation and operation in UASB-2 reactor, this was not achieved. COD removal efficiency in the UASB-1 reactor was little. To enhance COD efficiency of UASB-1 reactor, several parameters were needed to be changed. These changes included enhancing of OLRs and upflow velocity, decreasing hydraulic retention time and operating with new sludge.

Key words: UASB reactor, stillage, wastewater treatment plants

INTRODUCTION

Stillage, also termed as distillery wastewater, is the aqueous by-product from the distillation of ethanol following fermentation of carbohydrates. The pollution potential of stillage can exceed of 100 g/L as chemical oxygen demand (Wilkie *et al*.,2000). Upto 20 liters of stillage may be generated for each liter of ethanol produced (Haandel and Catunda, 1998). A medium-sized ethanol facility producing 1,000,000 L ethanol/yr generates stillage with a pollution level equivalent to the sewage of a city with a population of 500,000 (Lele *et al*., 1989). One of the methods that are used for treating ethanol distillery wastewater, is the application of upflow anaerobic sludge blanket(UASB)reactor. The same studies have been done by Alper *et al*. ,(2006). Results have shown that efficiency can enhance to 90 percent to eliminate initial pollutants from wastewater. UASB reactors belong to the group of high–rate anaerobic reactors with a sludge bed. Granular biomass with high methanogenic activity and excellent settling properties can be cultivated in these reactors (Buzzini *et al*., 2006). Startup and granulation are very important parts in operation of UASB reactor. In a study by Soto *et al*., (1997) was reported the influence of temperature on the granulation process during the startup of UASB reactor. Digesters treat a dilute synthetic wastewater at mesophilic (30Úc) and psychrophilic (20Úc) temperature. Results were shown that the granulation process is followed by a similar pattern and both temperature and complete granulation are achieved between 1 and 2 months after the start up (Ligero *et al*., 2002). The UASB reactor consists of a sludge bed in the lower part and a three phase separator (gas–liquid–solid) in the

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